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Titel des Beitrags: Three-dimensional optoacoustic monitoring of lesion formation in real time during radiofrequency catheter ablation.

Abstract: Due to lack of reliable imaging contrast from catheter radiofrequency ablation (RFA) lesions, the vast majority of current procedures rely on indirect indicators of ablation activity, resulting in a significant number of arrhythmia reoccurrences after RFA procedures and the need for repeat surgeries. The objective of this work is to develop an accurate method for on-the-fly assessment of the durability and size of lesions formed during RFA procedures. Radiofrequency catheter ablation on freshly excised porcine ventricular myocardial tissue was optoacoustically monitored by means of pulsed-laser illumination in the near-infrared spectrum. Lesion formation during ablation was captured at a rate of 10 Hz with a 256-detector optoacoustic imaging probe. Postablated samples were imaged using multispectral excitation in the wavelength range 740-860 nm to determine the lesion contrast spectrum. Tomographic reconstruction was performed to generate 3-dimensional images of the lesions, which were compared to photographs depicting the final ablated tissue samples. Video-rate 3-dimensional tomographic reconstructions depict formation of the lesion with high contrast and spatial resolution. The size and geometry of the lesion was shown to be in excellent agreement with the histological examinations. The wavelength dependence of the lesion contrast shows a contrast peak near
780 nm. Deep-tissue 3-dimensional monitoring of RFA lesion generation in real time was demonstrated for the first time in this work. The results suggest the potential of optoacoustic monitoring for providing critical feedback on lesion position and size during radiofrequency catheter ablation, improving safety and efficacy of these treatments.